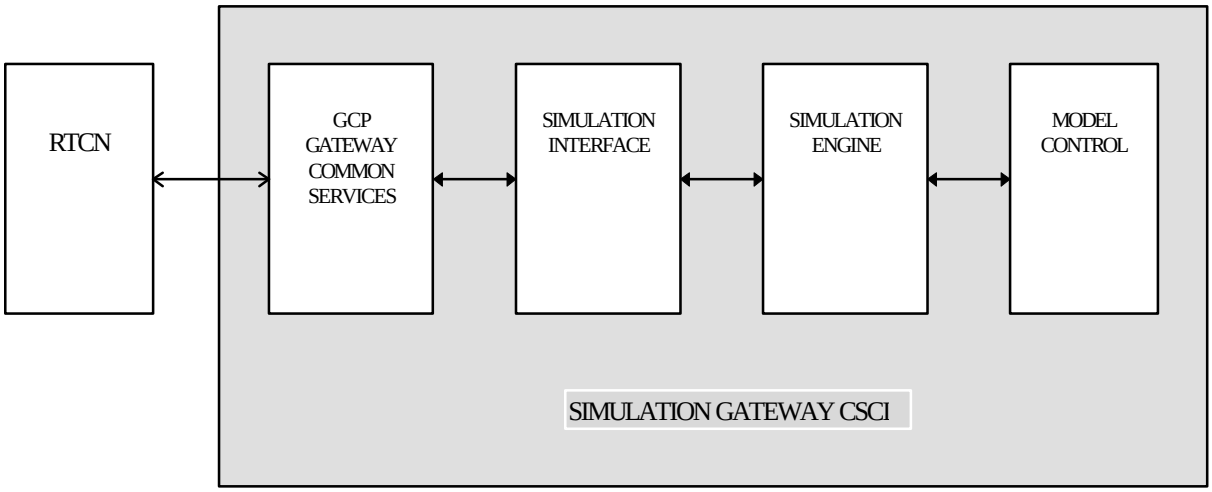
1.1 Simulation Gateway CSCI

1.1.1 Simulation Gateway CSCI Introduction

Simulation Gateway CSCI Overview

The Simulation Gateway CSCI provides the capability to connect the SGOS Math Models to the CLCS RTCN without the use of front end gateways or Video Simulation Interface (VSI) equipment. The Simulation Gateway CSCI utilizes the Simulation Engine currently in use by the SGOS Re-host and provides an interface to the GCP Gateway Common Services to perform this function.



1.1.2 Simulation Gateway CSCI Operational Description

The Simulation Gateway CSCI provides the capability for an SGOS Math Model to interface to the CLCS RTCN directly.

The SGOS Math Model is loaded onto the Simulation Engine where it is executed. Model Commands are received by the RTCN or a model control workstation which can stimulate the model using model control commands and/or pre-compiled procedures. The RTCN model commands are received by the Gateway Control Processor through the use of Application Program Interfaces (APIs) via the Simulation Interface. Model measurement values are sent to the RTCN through the same interface.

1.1.3 Simulation Gateway CSCI Operating Modes

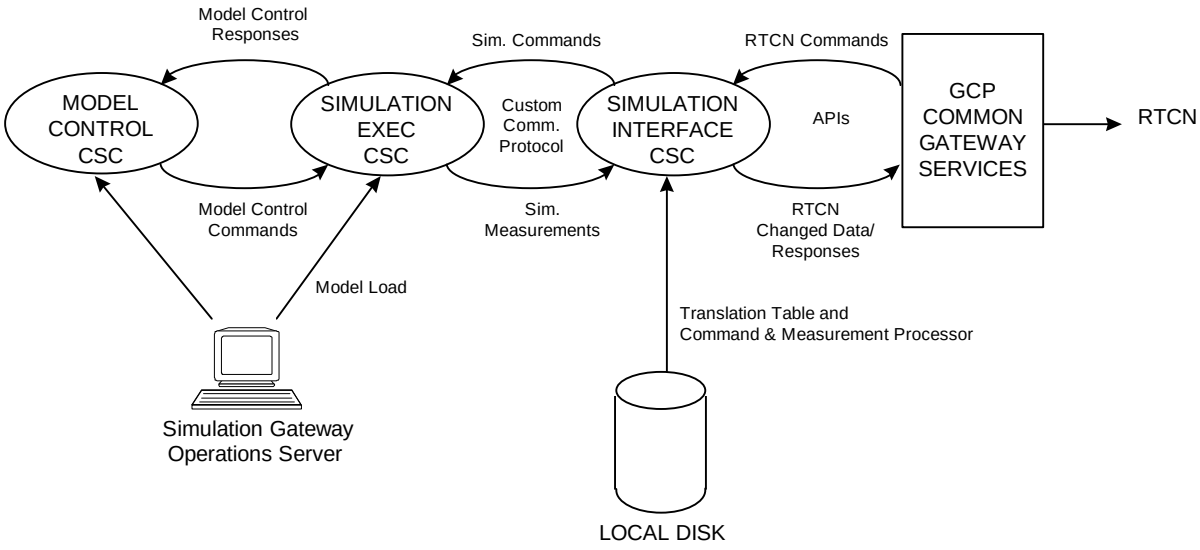
The only Operating mode supported by the Simulation Gateway CSCI will be model execution.

1.1.4 Simulation Gateway CSCI Computer Software Components

The Simulation Gateway CSCI is composed of the following CSCs:

- Model Control CSC
- Simulation Executive CSC
- Simulation Interface CSC

1.1.5 Simulation Gateway CSCI Data Flow/Interface Diagram

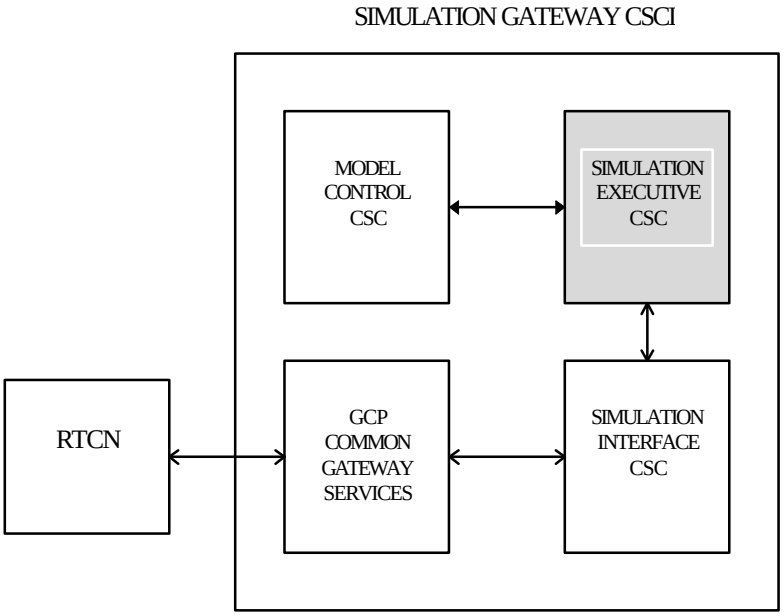


1.2 Simulation Executive CSC

1.2.1 Simulation Executive CSC Introduction

1.2.1.1 Simulation Executive CSC Overview

The Simulation Executive CSC provides a means of executing an SGOS Math Model and the procedures associated with that Model. The Simulation Executive CSC is a set of processes and tables residing on the Simulation Engine which executes the SGOS Math Model, generates Model measurements, and receives and responds to Model commands.



1.2.1.2 Simulation Executive CSC Operational Description

The Simulation Executive CSC performs the execution of a Model and any associated pre-compiled SGOS Model Control Procedures. Execution is segment-based and will operate on a 50 ms cycle for the Thor~~Redstone~~ delivery. First, Model segments (functions) are queued for execution. During the second stage of execution, Model segments are executed based on a pre-determined sequence called ranking. In the time remaining, the different Simulation Executive I/O processes are polled for any incoming Commands. The Simulation Executive accepts SGOS Model Control Procedure outputs, SGOS Model Control Commands and Console Commands for Model stimulation.

The Simulation Executive CSC uses Command and Measurement toggle buffers to receive Console Commands and store changed Model Measurements. The data from these buffers is stored and read by the Simulation Interface Board (SIB) across the VME bus using a custom communication protocol (the SIB will be discussed further in the Simulation Interface CSC). The Simulation Executive reads the Console Commands from the Command buffers and queues them for processing in the model. As the model runs, and as Console Commands are executed, the Simulation Executive stores changed model data values in the Measurement buffers.

The Simulation Executive CSC contains a TCP/IP server for SGOS Model Control. A TCP/IP client can connect to the server to initiate SGOS Model Control procedures and issue SGOS Model Control Commands.

1.2.2 Simulation Executive CSC Specifications

1.2.2.1 Simulation Executive CSC Groundrules

- The Simulation Executive will reside on the Simulation Engine.
- The Simulation Executive will function as designed for the Simulation Re-host effort.
- The communication protocol used for the VMEbus communication between the SIB and the Simulation Engine will be the same protocol used in the Simulation Re-host effort for communication between the Simulation Engine and the VSI.
- The Simulation Executive will support the execution of the HMF, ~~and~~ Refrigerator/Freezer, or Thor (TBD) ~~-~~models.
- The Simulation Executive will not support data logging.
- The Simulation Executive will support a TCP/IP server for communication over the ethernet with the SGOS Model Control CSC.
- Specific SGOS Commands which are responded to by the VSI will not be supported for the Thor~~Redstone~~ delivery.
- The Simulation Executive shall not support FDIDs as indexes into the model.

1.2.2.2 Simulation Executive CSC Functional Requirements

The Functional Requirements for the Simulation Executive are arranged in the following major/minor functions:

1. Load and Execution
2. Console Commands
3. SGOS Model Control Commands
4. Model Measurements

1 Load and Execution

The Simulation Executive CSC provides the capability to select, load and execute an SGOS Math Model on the Simulation Engine.

1.1 The Simulation Executive and Model to be run shall be loaded from the Simulation Gateway Operations Server. ~~local disk (TBD)~~.

1.2 The Simulation Executive shall advertise its Command and Measurement toggle buffer addresses for use by the SIB.

1.3 The Simulation Executive shall be the highest priority task on the Simulation Engine.

1.4 The Simulation Executive shall operate on a 50 ms cycle during execution of the HMF, ~~or~~ Refrigerator/Freezer, or Thor (TBD) m~~M~~odels.

1.5 The Simulation Executive shall be able to execute the HMF , ~~model and the~~ Refrigerator/Freezer or Thor (TBD) model.

1.6 The Simulation Executive shall use the following as incoming command sources:

1.6.1 Simulation Engine's Command toggle buffers which receive the commands from the RTCN.

1.6.2 Simulation Engine's TCP/IP server which receives the commands from the TCP/IP client (Terminal Mode).

1.7 The Simulation Executive shall use the Measurement toggle buffers as the outgoing measurement source.

1.8 The Simulation Executive TCP/IP server shall issue a response to Model Commands issued by the TCP/IP client.

2 Console Commands

The Simulation Executive accepts, executes and responds to Console Commands received from the RTCN.

2.1 The Simulation Executive shall read in Console Commands from the Command toggle buffers located on the Simulation Engine.

2.2 Incoming Console Commands shall be queued for execution in the model.

2.3 The Simulation Executive shall switch the Command buffer from which it is reading every model cycle, or if the buffer is full.

2.4 The Simulation Executive shall support the following incoming Console Commands:

- 2.4.1 Apply- Send an analog stimulus or time value to the model under test.
- 2.4.2 Set- Sets a discrete type model name under test.

2.5 The Simulation Executive shall accept IEEE Floating Point as the data format for incoming Console Commands.

2.6 The Simulation Executive shall accept Data Value Storage Index values as indexes into the model.

3 SGOS Model Control Commands

The Simulation Executive accepts, executes and responds to Model Control Terminal Commands from the TCP/IP client.

3.1 The Simulation Executive shall read in SGOS Model Control Commands from its TCP/IP server located on the Simulation Engine.

3.2 Incoming SGOS Model Control commands shall be queued for execution in the model.

3.3 The Simulation Executive shall support the following incoming SGOS Model Control commands:

- 3.3.1 Apply - Send an analog stimulus or time value to the model under test.
- 3.3.2 Set - Sets a discrete type model name under test.
- 3.3.3 Fail - Fail a databank model name or modular name to a special quantity or state.
- 3.3.4 Display - Provides the capability to output information to the terminal.
- 3.3.5 Perform - Initiates the execution of a specified procedure.
- 3.3.6 Reset - Provides the capability to perform the following:
  - 3.3.6.1 Reset on or all failed variables.
  - 3.3.6.2 Cease plotting one or all plot variables.
  - 3.3.6.3 Cease tracing one or all trace variables.
  - 3.3.6.4 Reset all failed variables and halt all plot and trace activities.
- 3.3.7 Status - Provides various terminal or on-line model segment execution information.

3.3.8 Exit - Discontinue the client/server model control session.

3.4 The Simulation Executive shall support all HMF, ~~and~~ Refrigerator/Freezer, and Thor (TBD) model~~s'~~ pre-compiled procedures.

3.5 The Simulation Executive shall accept IEEE Floating Point as the data format for incoming SGOS Model Control commands.

3.6 The Simulation Executive shall provide a remote shell daemon to process system commands from the Model Control CSC.

4 Model Measurements

The Simulation Executive CSC writes any changed Model Data into the Measurement buffer.

4.1 The Simulation Executive shall write Model Measurements to the Measurement toggle buffers located on the Simulation Engine.

4.2 The Simulation Executive shall switch the Measurement buffer to which it is writing every Model cycle, or if the buffer is full.

4.3 The Simulation Executive shall write IEEE Floating Point as the data format for outgoing Model Measurements.

1.2.2.3 Simulation Executive Performance Requirements

Cycle Time

The Simulation Executive shall maintain a 50 ms model execution cycle time for the HMF, ~~and~~ Refrigerator/Freezer , and Thor (TBD) m~~M~~odels.

1.2.2.4 Simulation Executive Interfaces Data Flow Diagrams

Refer to the Simulation Gateway CSCI Data Flow Diagram.

1.2.3 Simulation Executive CSC Design Specification

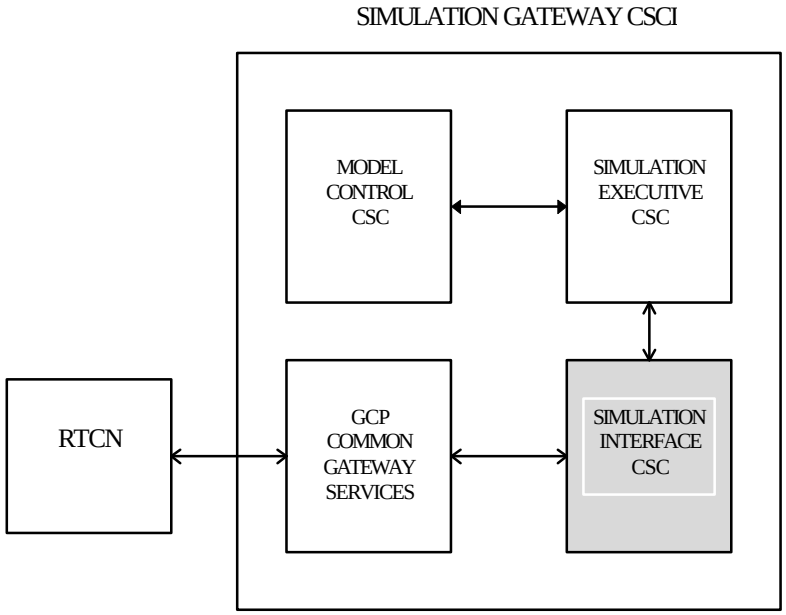
The Simulation Executive CSC will operate as designed by the Simulation Re-host project.

1.3 Simulation Interface CSC

1.3.1 Simulation Interface CSC Introduction

1.3.1.1 Simulation Interface CSC Overview

The Simulation Interface CSC serves as the interface between the Simulation Engine and the Gateway Control Processor. The Simulation Interface CSC provides three main functions: Command Processing, Measurement Processing and a translation table that is used to map an FDID with its corresponding Data Value Storage (DVS) Index These functions reside on the Simulation Interface Board (SIB).



1.3.1.2 Simulation Interface CSC Operational Description

The Simulation Interface CSC provides all of the processes and interfaces necessary for commands and measurements to flow between the Simulation Engine and the GCP.

Console commands are received by the GCP through Application Program Interface (API) functions using shared memory message queues. The commands are processed by the Command Processor function which takes the commands and places them into a command buffer residing on the Simulation Engine for model execution.

Model measurements are pulled by the Model Processor function from a measurement buffer residing on the Simulation Engine and passed to the GCP through API functions.

Finally, the Simulation Interface CSC performs the translation between an FDID and its corresponding Data Value Storage (DVS) Index.

1.3.2 Simulation Interface CSC Specifications

1.3.2.1 Simulation Interface CSC Ground Rules

- Communication with the Simulation Interface CSC will be supported through shared memory message queues.
- Communication with the Simulation Executive CSC will be supported through a custom communication protocol currently supported by the Simulation Re-host effort.
- The Simulation Interface CSC will reside on the SIB.
- A list of FDIDs and corresponding DVS Indexes for the Refrigerator Freezer, ~~and~~ HMF and Thor (TBD) models will be provided by the Test Build and Load CSCI.
- A list of FDIDs and corresponding de-scaling coefficients for the Refrigerator Freezer, ~~and~~ HMF and Thor (TBD) models will be provided by the Test Build and Load CSCI.
- The capability to initialize and load the Simulation Interface CSC functions and tables will be from local disk ~~(TBD)~~.
- ~~The Simulation Executive CSC will inform the Simulation Interface CSC where the command and measurement buffers are located in memory~~.

1.3.2.2 Simulation Interface CSC Functional Requirements

The functional requirements for the Simulation Interface CSC are arranged in the following major/minor functions:

1. Load and Initialization
2. Command Processing
3. Measurement Processing
4. Translation Table
5. Subsystem Integrity

1 Load and Initialization

The Simulation Interface CSC loads and initializes all of the functions and tables on the Simulation Interface Board (SIB) required by the Simulation Engine and the GCP for communication.

1.1 ~~The Simulation Interface CSC shall obtain the Command and Measurement buffer start address from the Simulation Executive CSC~~.

1.2 The Simulation Interface CSC shall register with the GCP through Shared Memory Message Queues.

1.3 The Simulation Interface CSC shall perform all initialization routines required by the GCP Services API.

1.4 The Simulation Interface CSC shall load the translation tables which correspond to the SGOS Model to be executed.

1.5 The Simulation Interface CSC shall load and initialize the Command Processor function.

1.6 The Simulation Interface CSC shall load and initialize the Measurement Processor function.

1.7 The Simulation Interface CSC shall utilize Route Code 0 for internal Gateway Communications.

2 Command Processing

The Simulation Interface CSC provides the capability to process Console commands and commands received from the Model Control CSC.

2.1 Simulation Interface shall receive RTCN commands asynchronously from the Common Gateway Services CSCI using shared memory message queues.

2.2 An incoming RTCN command's FDID shall be indexed into the Translation Table to determine that command's DVS Index.

2.3 The Simulation Interface shall respond to analog commands with a response containing:

- Completion Code for the response header
- Requested Floating Point value
- Received Floating Point value
- Received raw count

2.4 The Simulation Interface shall respond to discrete commands with a response containing:

- Completion Code for the response header
- Requested state (0=0x0000, 1=0xffff)
- Received state (0=0x0000, 1=0xffff)

2.5 When an incoming RTCN command's FDID is not found in the Translation Table, a NACK response will be returned to the command's source.

2.6 An incoming RTCN command that has successfully indexed the Translation Table shall have it's data paired with its DVS Index in a 32 bit format and forwarded to the Simulation Executive CSC via the VMEbus.

2.7 Simulation Interface shall write Simulation Commands to the Simulation Executive CSC's Command toggle buffers located on the Simulation Engine.

3 Measurement Processing

The Simulation Interface CSC provides the capability to accept measurements from the Simulation Executive Measurement Buffer and send them to the GCP.

3.1 Simulation Interface shall read Simulation Measurements from the Simulation Executive CSC's Measurement toggle buffers located on the Simulation Engine.

3.2 An outgoing Simulation measurement's DVS Index shall be indexed into the Translation Table to determine that measurement's FDID.

3.3 When an outgoing Simulation measurement's DVS Index is not found in the Translation Table, the Measurement Processing function shall respond with a system message.

3.4 An outgoing Simulation measurement that has successfully indexed the Translation Table shall have it's data stored in a Change Data Packet and forwarded to the Common Gateway Services CSCI for RTCN transmission.

3.5 Simulation Interface shall generate change data packets asynchronously to the Common Gateway Services CSCI using shared memory message queues.

3.6 Simulation Interface shall convert model measurements (which are in linear counts) to engineering units.

4 Translation Table

The Simulation Interface CSC provides a translation table for converting an FDID to a corresponding DVS Index, obtaining the scaling coefficients for a corresponding FDID, and obtaining the logical source for a measurement.

4.1 The Simulation Interface CSC shall provide the capability to select the Translation Table for the corresponding model (HMF or Refrigerator/Freezer) to be executed.
4.2 The Simulation Interface CSC translation table shall provide the capability to translate an FDID to its corresponding Data Value Storage (DVS) Index for the model under execution.
4.3 The Simulation Interface CSC translation table shall provide scaling coefficients for each FDID.
4.4 The Simulation Interface CSC translation table shall provide the capability to translate a DVS Index to its corresponding FDID for the model selected by the Simulation Executive CSC.
4.5 The Simulation Interface CSC translation table shall provide a logical source ID for each outgoing DVS Index.
4.6 The Simulation Interface CSC shall provide functions to load and access the translation table from the command and measurement processors.

5. Subsystem Integrity

The Simulation Interface CSC provides board level integrity to the Common Gateway Services for monitoring the health and status of the Simulation Gateway.

5.1 The Simulation Interface CSC shall register each task using the task registration function
provided by the Common Gateway Services.
5.2 The Simulation Interface CSC shall update its Health counter at a rate of (TBD).

1.3.2.3 Simulation Interface CSC Performance Requirements

1 Command/Measurement Processor Timing

A. Simulation Executive - The Simulation Interface CSC shall provide commands and receive measurements according to the timing requirements stated by the Simulation Executive CSC.

B. GCP - The Simulation Interface CSC shall provide measurements and receive commands according to the timing requirements stated by asynchronously to the GCP Common Gateway Services CSCI.

1.3.2.4 Simulation Interface CSC Interfaces Data Flow Diagram

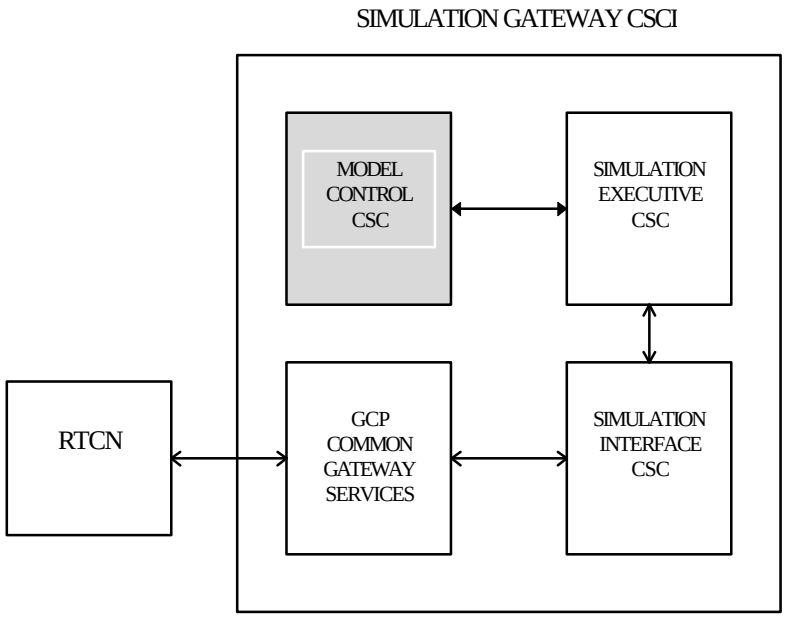
Refer to the Simulation Gateway CSCI Data Flow Diagram.

1.4 SGOS Model Control CSC

1.4.1 SGOS Model Control CSC Introduction

1.4.1.1 SGOS Model Control CSC Overview

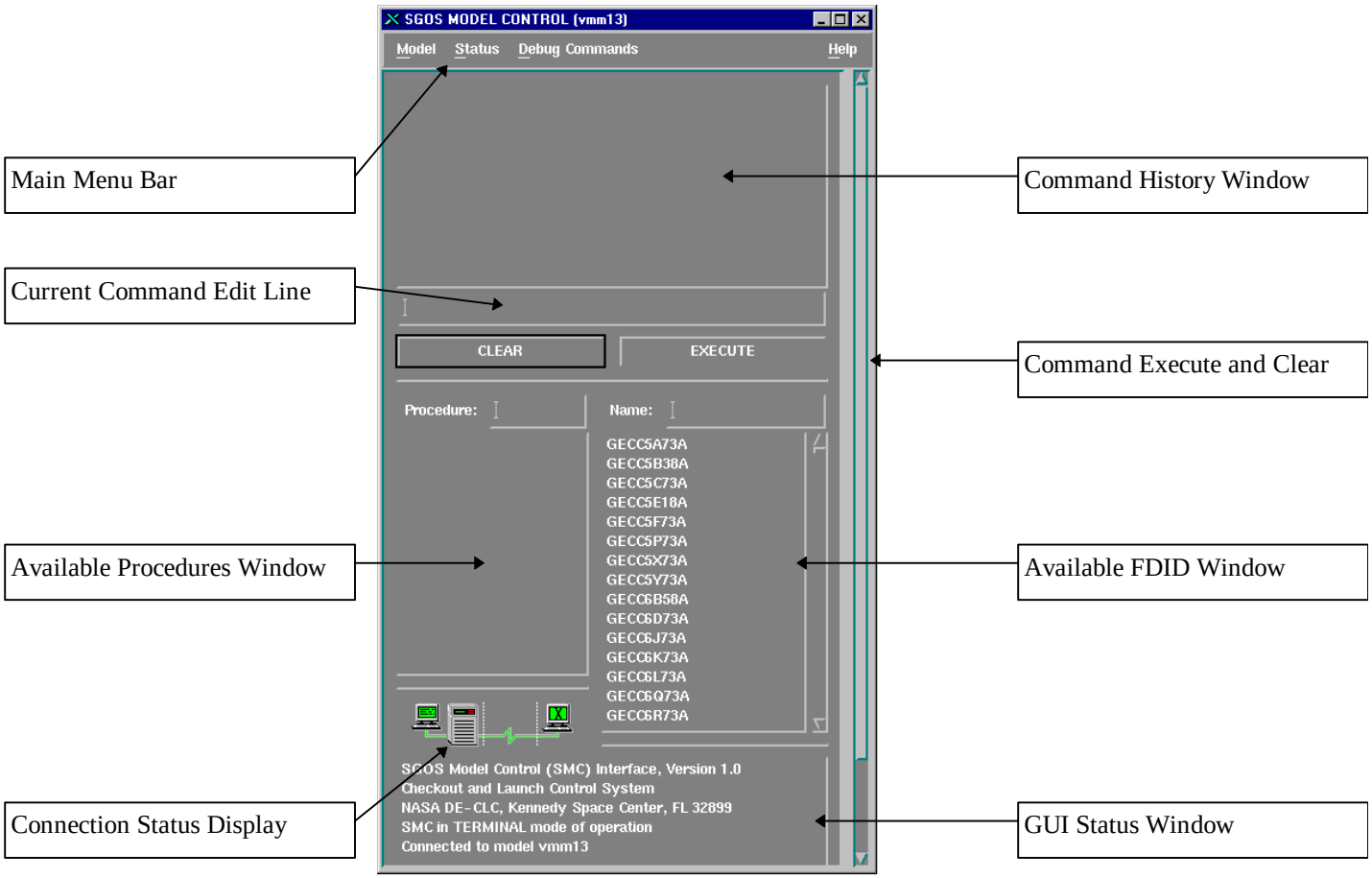
The SGOS Model Control CSC provides a means of interfacing to an executing SGOS Math Model and stimulating that Model through Model Control Commands and by initiating pre-compiled procedures. The SGOS Model Control CSC is a set of processes and a user interface residing on the Simulation Gateway Operations Workstation in each SDE and IDE.



1.4.1.2 SGOS Model Control CSC Operational Description

SGOS Model Control provides a TCP/IP socket communication client which links with the Simulation Engine server. The physical medium for this link is ethernet and will be internal to its respective development environment. Using this communication method, any Model Control Commands may be sent to the SGOS Model. The Model may be started, stopped, and commanded through this communication link. Also, any pre-compiled procedures may be performed on the Model through this link.

SGOS Model Control uses a Graphical User Interface (GUI) to implement a user-friendly environment by which the Model may be controlled. The GUI is X-Windows/Motif-based and will run on the Simulation Gateway Operations Workstation.



1.4.2 SGOS Model Control CSC Specifications

1.4.2.1 SGOS Model Control CSC Groundrules

- SGOS Model Control will reside on the Simulation Gateway Operations Workstation.
- SGOS Model Control will only be performed within an SDE or ~~/~~IDE ~~(TBD – Network Security)~~.

1.4.2.2 SGOS Model Control CSC Functional Requirements

The Functional Requirements for the SGOS Model Control are arranged in the following major/minor functions:

1. Communication Link
2. Commands and Procedures
3. User Interface

1 Communication Link

The SGOS Model Control CSC provides the capability for the TCP/IP client to connect to the TCP/IP server for controlling the SGOS Model.

1.1 SGOS Model Control shall initiate all communication with the Simulation Executive CSC.

1.2 SGOS Model Control shall support a TCP/IP socket client for communication over the ethernet with the Simulation Executive CSC.

1.3 SGOS Model Control shall use remote shell to implement the following system commands to the Simulation Engine:

- 1.3.1 Starting the Model.
- 1.3.2 Stopping the Model.
- 1.3.3 Rebooting the Simulation Engine.

2 Commands and Procedures

The SGOS Model Control CSC provides the capability to issue Model Control Commands and Procedures.

2.1 SGOS Model Control shall send all Model Control commands to the Simulation Executive CSC via its TCP/IP socket communication client.

2.2 SGOS Model Control shall support the following SGOS Model Control commands:

- 2.2.1 Apply
- 2.2.2 Set
- 2.2.3 Fail
- 2.2.4 Display
- 2.2.5 Perform
- 2.2.6 Reset
- 2.2.7 Status
- 2.2.8 Exit

For a description of the above Model Control commands, refer to section 1.2.2.2.

2.3 The SGOS Model Control shall support all HMF, ~~and~~ Refrigerator/Freezer, and Thor (TBD) model~~s'~~ pre-compiled procedures.

2.4 The SGOS Model Control shall generate IEEE Floating Point as the data format for outgoing Commands.

2.5 The SGOS Model Control shall provide the capability to issue discrete commands.

3 User Interface

The SGOS Model Control CSC provides a user interface for issuing commands to the SGOS Model.

3.1 The SGOS Model Control shall include a User Interface capable of establishing the TCP/IP socket communication with the Simulation Executive CSC.

3.2 The SGOS Model Control User Interface shall include the capability to implement all the above mentioned SGOS Model Control commands.

3.3 The SGOS Model Control User Interface shall include the capability to perform all the above mentioned SGOS Model Control procedures.

3.4 The SGOS Model Control User Interface shall include the capability to implement all the above mentioned Simulation Engine remote shell commands.

1.4.2.3 SGOS Model Control CSC Performance Requirements

N/A

1.4.2.4 SGOS Model Control CSC Interfaces Data Flow Diagrams

Refer to the Simulation Gateway CSCI Data Flow Diagram.

1.4.3 SGOS Model Control CSC Design Specification

The SGOS Model Control CSC will operate as designed by the Simulation Re-host project